INDOT SEAL COAT DESIGN SOFTWARE MANUAL

Version 1.0.1

May 2011

DISCLAIMER

The contents of this manual do not necessarily reflect the official views or policies of the Indiana Department of Transportation (INDOT). The details in this manual are intended for reference only, not as specifications or design guidance. In the event that any information presented herein conflicts with the Indiana Design Manual, INDOT Standard Specifications or other INDOT policy, said policy will take precedence.

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1 INTRODUCTION

The design software “INDOT SEAL COAT DESIGN (iSeal)” was developed to aid the seal coat design process and incorporate INDOT seal coat practice. The software is largely based on the McLeod design method. Furthermore, one additional factor, an equipment factor, was implemented into the design process to resolve issues due to discrepancies between the designed rate and the applied rate.

During development, engineers emphasized intuitiveness in using the software, thus providing more user-friendly software. In addition, the software provides various options when inputting values, namely “User-Defined”, “Typical” and “Measured”. “User-defined” allows a user to manually input desired values while “Typical” provides selection of generally accepted values for a given factor. “Measured” accepts experiment data and then converts this into a corresponding value.

2 INSTALLLATION GUIDE

2.1 BEFORE INSTALLING

iSeal was developed using ADOBE Flex technology and requires ADOBE AIR 2.6 to run the application. You can download ADOBE AIR 2.6 or newer version from http://get.adobe.com/air/.

In addition, you need to check that your computer has the following minimum requirements to run iSeal:

Windows

- Intel® Pentium® 4 processor
- Microsoft® Windows® XP Home, Professional, or Tablet PC Edition with Service Pack 2 or 3, Windows Server® 2003 or later
- 512MB of RAM

Apple

- Intel® Core® Duo
- Mac OS X v.10.4.9 or later
- 512MB of RAM

Linux

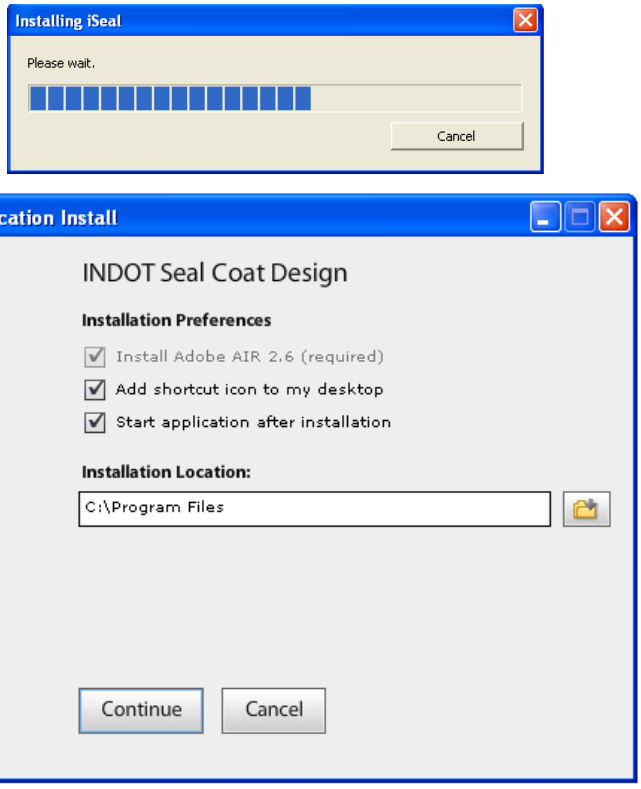
- Intel® Pentium® 4 processor
- Fedora® Core 12, Ubuntu® v. 9 or later, or openSUSE® v.11.2 or later
- 512MB of RAM

2.2 INSTALLING ISEAL

To install iSeal, follow these steps:

1. Before you can install iSeal, you will need to download ADOBE AIR 2.6 or newer version and install it. If you have already done this, you can skip this step.
2. Download iSeal installer from TBD. The iSeal installer icon should appear on your desktop, similar to the one below:

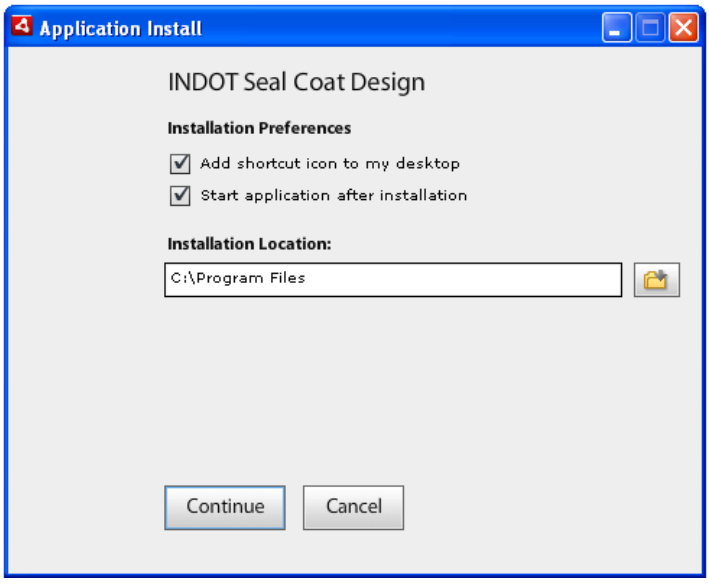
3. Run iSeal Installer by double-clicking on the iSeal_Install icon on your desktop. An application install status window should appear followed by an application install window. Click the **Continue** button to continue.



4. You will be asked whether ADOBE AIR to be installed or not if you have not already installed ADOBE AIR in your computer. Click the **I Agree** button to continue.

Application Install
INDOT Seal Coat Design
Adobe® AIR® (required component)
This installer will setup Adobe AIR, software that enables web-connected desktop applications. Please review and agree to the license agreement to continue.
ADOBE SYSTEMS INCORPORATED
Personal Computer Software License Agreement
1. WARRANTY DISCLAIMER, BINDING AGREEMENT AND ADDITIONAL TERMS AND AGREEMENTS.
1.1 WARRANTY DISCLAIMER . THE SOFTWARE AND OTHER INFORMATION IS DELIVERED TO YOU "AS IS" AND WITH ALL FAULTS. ADOBE, ITS SUPPLIERS AND CERTIFICATION AUTHORITIES DO NOT AND CANNOT
By clicking the "I Agree" button I acknowledge that I have read and accept the terms of the above agreement.
I Agree
Cancel

5. You will then have to specify the installation location and click the **Continue** button.



6. You have finished installing iSeal and an iSeal icon shown below should now appear on your Windows desktop.

3 OVERVIEW

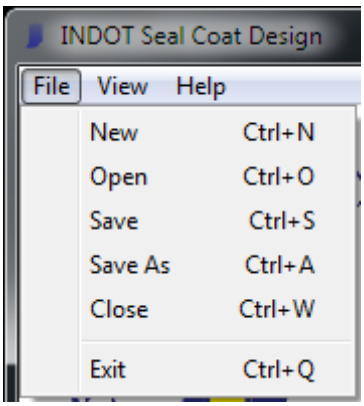
iSeal consists of five tabs, namely **General**, **AAR**, **EAR**, **Summary** and **Attachments**. In addition, iSeal features a status indicator and application menus.

3.1 APPLICATION MENU

Application menus are located in the upper left corner of the window and consist of **File**, **View** and **Help**.

3.1.1 FILE

The figure below illustrates the **File** menu.

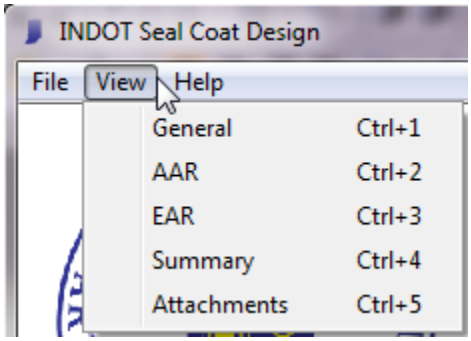


- **New**: Opens a new sheet. Up to five sheets can be opened at the same time (Keyboard shortcut CRTL + N).
- **Open**: Opens the selected file (Keyboard shortcut CRTL + O).
- **Save**: Saves the current work to a folder on your hard disk. The name of the file is automatically generated as Date_Time.indot and the default file save location is set to your computer's desktop. Once the file is saved, it saves the current work to a existing saved file (Keyboard shortcut CRTL + S).
- **Save As**: Saves the current work to a folder on your hard disk. The name of the file is automatically generated as Date_Time.indot and the default file save location is set to your computer's desktop (Keyboard shortcut CRTL + A).
- **Save As**: Closes the current sheet. (Keyboard shortcut CRTL + W)

- **Exit**: Closes the entire program. If there are multiple sheets, it closes them all at the same time (Keyboard shortcut CRTL + Q).

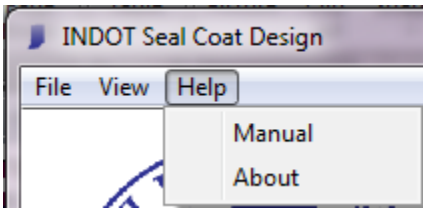
3.1.2 VIEW

The figure below illustrates the **View** menu. This allows a user to switch between different tabs and displays the keyboard shortcuts designated for each tab.



3.1.3 HELP

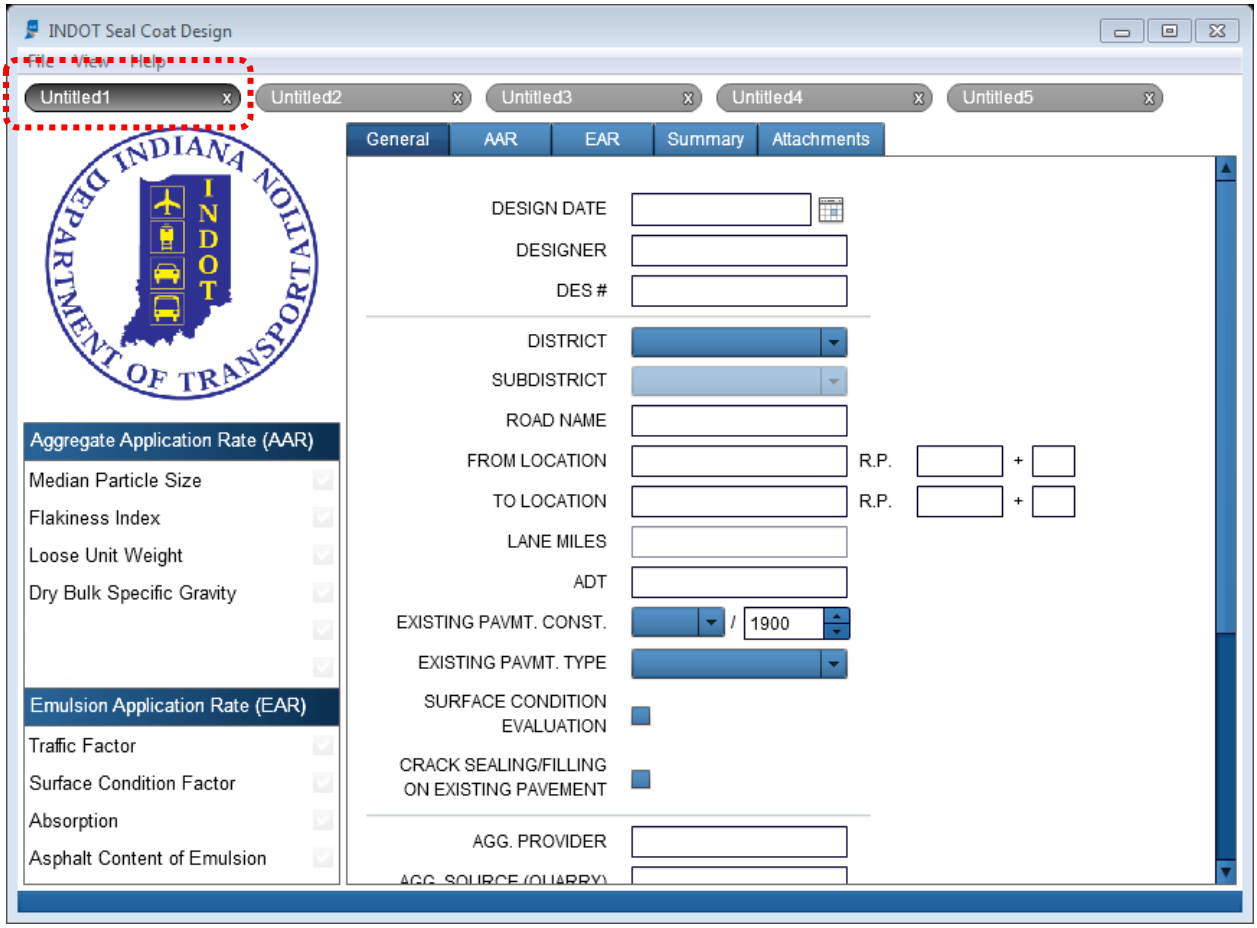
The figure below illustrates the **Help** menu. This provides the manual and software version information.



3.2 MULTIPLE SHEETS

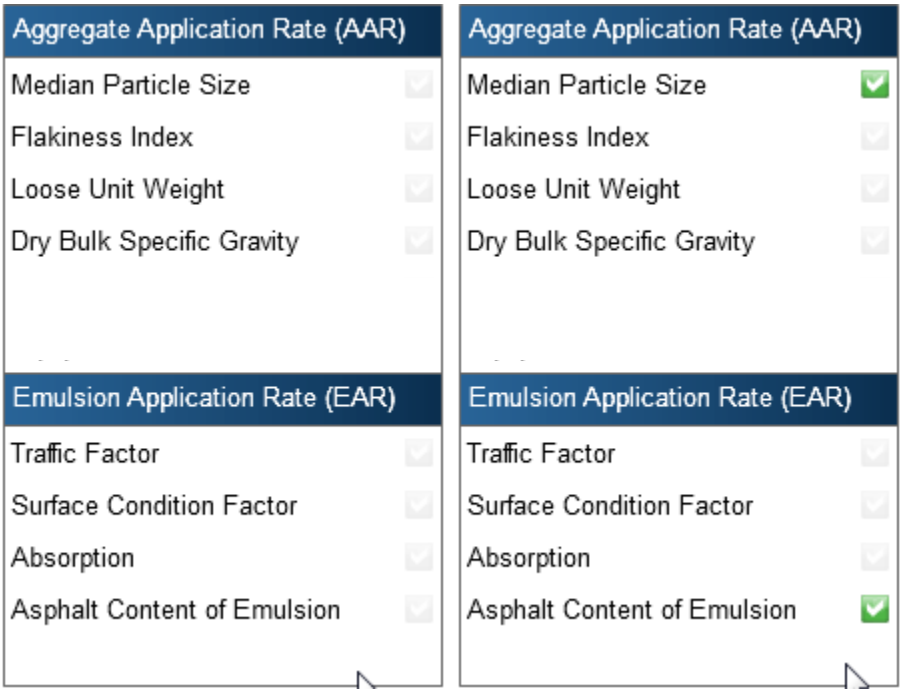
iSeal allows a user work with a number of sheets (up to five). And a user can easily switch between sheets in iSeal using either their keyboard shortcut (CTRL + Tab) or mouse by clicking on an individual sheet.

The figure below illustrates how multiple sheets are shown in iSeal along with their file name. The current sheet is indicated by darker color.



3.3 STATUS INDICATOR

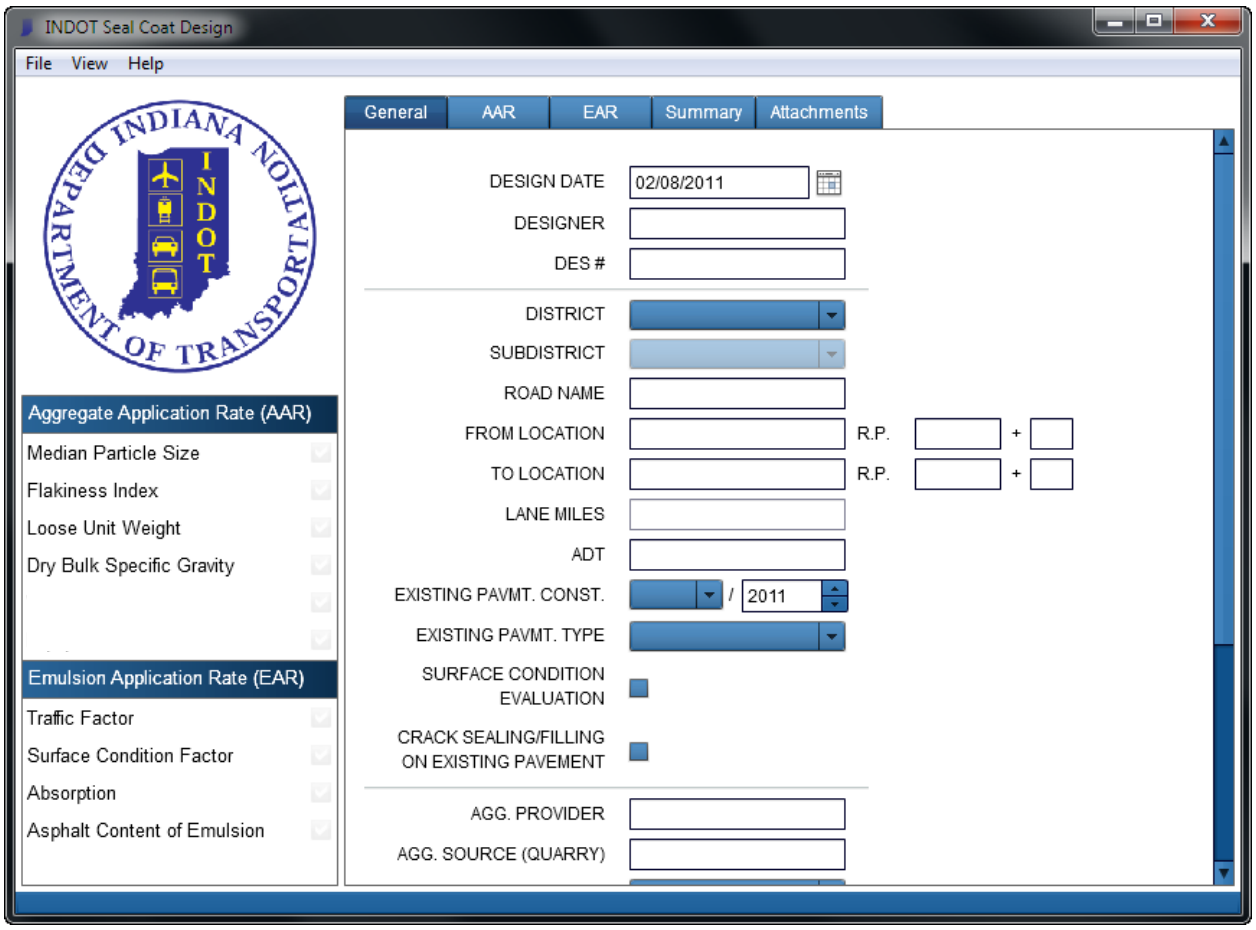
The status indicator is located in the lower left corner of the window and provides an overview of required inputs. The figure below illustrates how the status indicator displays once any change in the values of each required input is detected. It is advised that a user verify their inputs on the "Summary" tab since the status indicator does not check the validity of the input value.



3.4 TAB

3.4.1 GENERAL

The "General" tab is the default screen when the software is launched. This allows a user to input general information regarding specific seal coat design, including designer information and location along with existing pavement condition and material type and source. The District and Sub-district features are Indiana's, and existing pavement type selections are constructed based on the Indiana Design Manual Chapter 52 (1).



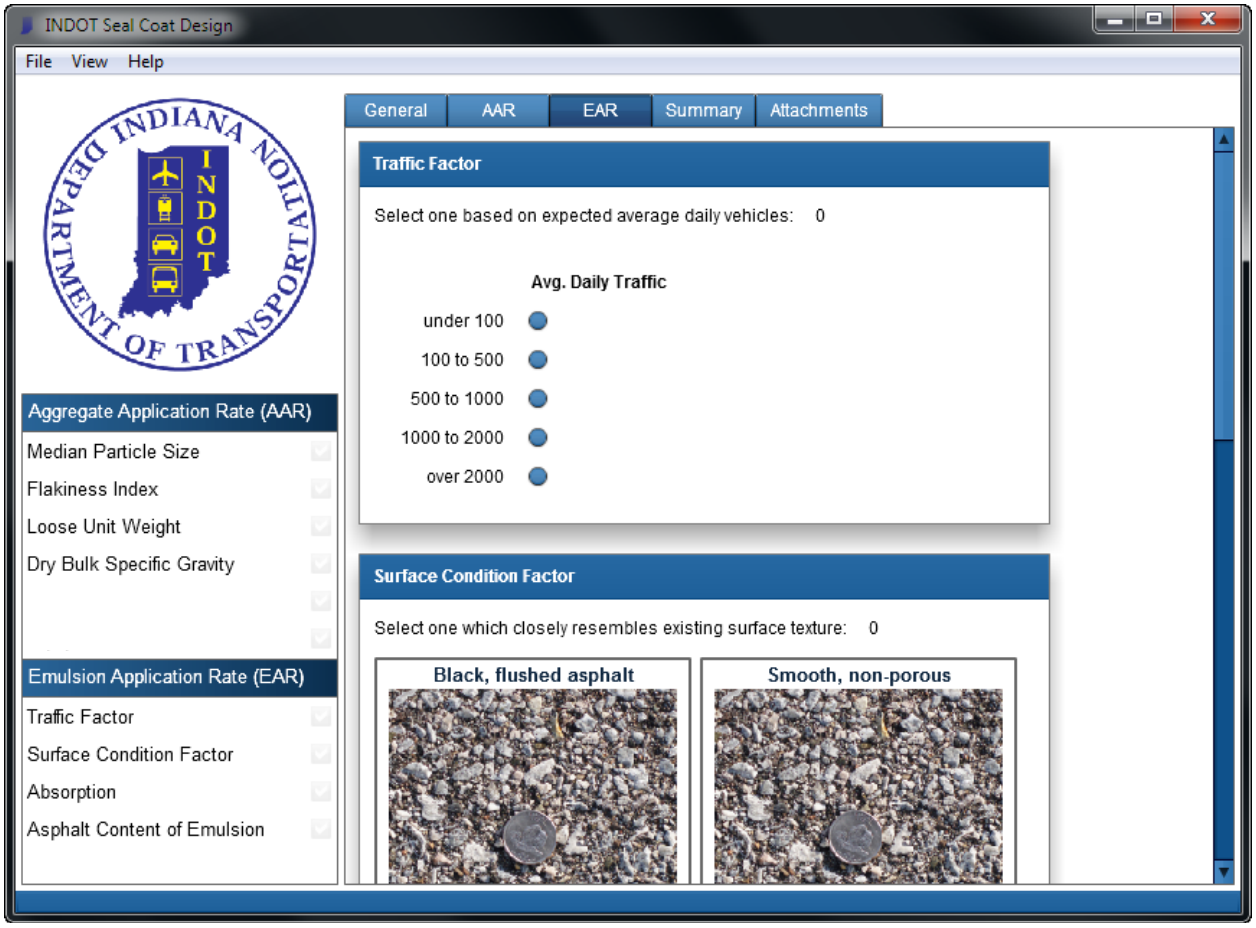
3.4.2 AAR

The "AAR" tab presents a user to input values required to calculate the aggregate application rate, including Median Particle Size, Flakiness Index, Loose Unit Weight, Dry Bulk Specific Gravity, Wastage Factor and Equipment Correction Factor. The "Typical" input option in the median particle size box allows a user to select among widely used sizes of aggregates, such as Indiana aggregates No. 11, No. 12 and SC-16. Upon selection, the software inputs the median particle size accordingly; values are based on INDOT Standard Specification (2). The values for Flakiness Index generally range from 10 to 25 %. Loose Unit Weight and Dry Bulk Specific Gravity should be obtained under AASHTO T 19 (3) and T 85 (4). Although the last two factors, which are a wastage factor and an equipment correction factor, are optional, it is strongly advised that the user apply these factors.

INDOT Seal Coat Design
File View Help
General AAR EAR Summary Attachments
Median Particle Size
Enter the median particle size: 0 in.
User Defined Typical Measured
Flakiness Index
Enter the flakiness index: 0 %
User Defined Measured
Loose Unit Weight
Enter the loose unit weight of the aggregate (AASHTO T 19): 0
User Defined Measured
Dry Bulk Specific Gravity
Enter the dry bulk specific gravity (AASHTO T 85): 0
Aggregate Application Rate (AAR)
Median Particle Size
Flakiness Index
Loose Unit Weight
Dry Bulk Specific Gravity
Emulsion Application Rate (EAR)
Traffic Factor
Surface Condition Factor
Absorption
Asphalt Content of Emulsion

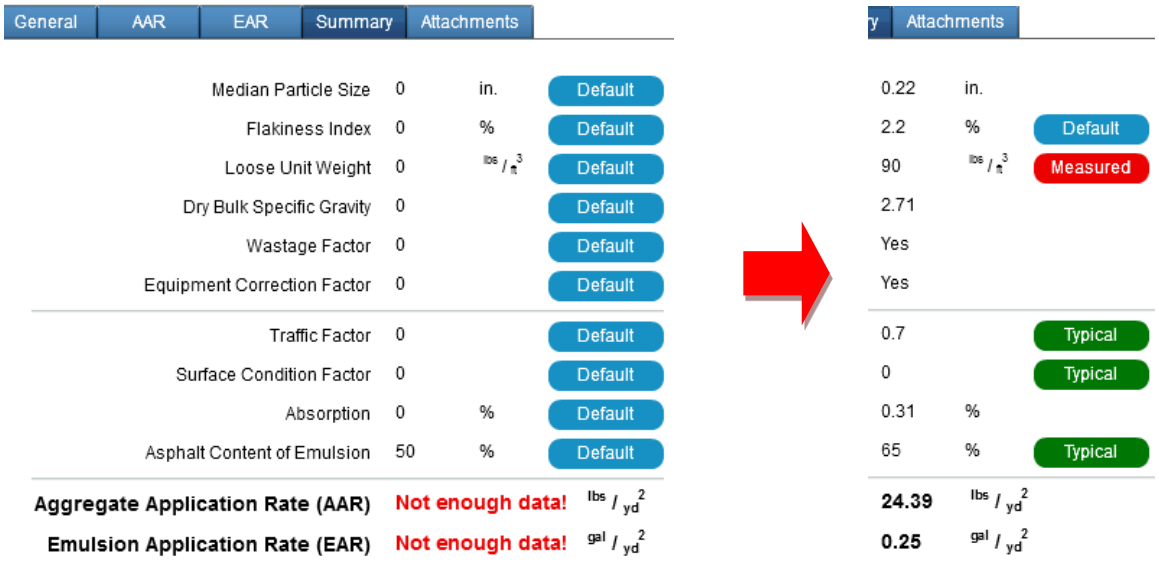
3.4.3 EAR

The "EAR" tab allows a user to input values required to calculate the emulsion application rate, including Traffic Factor, Surface Condition Factor, Absorption and Asphalt Content of Emulsion. Traffic factor is calculated based on the average daily traffic of the road. The Traffic Factor contributes significantly in designing EAR since it determines the average embedment depth, which ranges from 60 to 85 % of the average least dimension of aggregates. The Surface Condition Factor features five pictures to help a user determine the existing pavement condition and improve objectivity when selecting categories. The input value for Absorption is the water absorption of aggregates, although aggregate is mixed with emulsion in a seal coat application. This is mainly due to lack of testing methods that can measure the actual amount of emulsion absorbed by aggregates. The "Typical" input option is also available under the Asphalt Content of Emulsion box, which allows a user to select among widely used types of emulsion, namely RS-2, RS-2P, AE-90S and HFRS-2. Upon selection, the software inputs the asphalt content of the emulsion accordingly; values are based on INDOT Standard Specification (2).



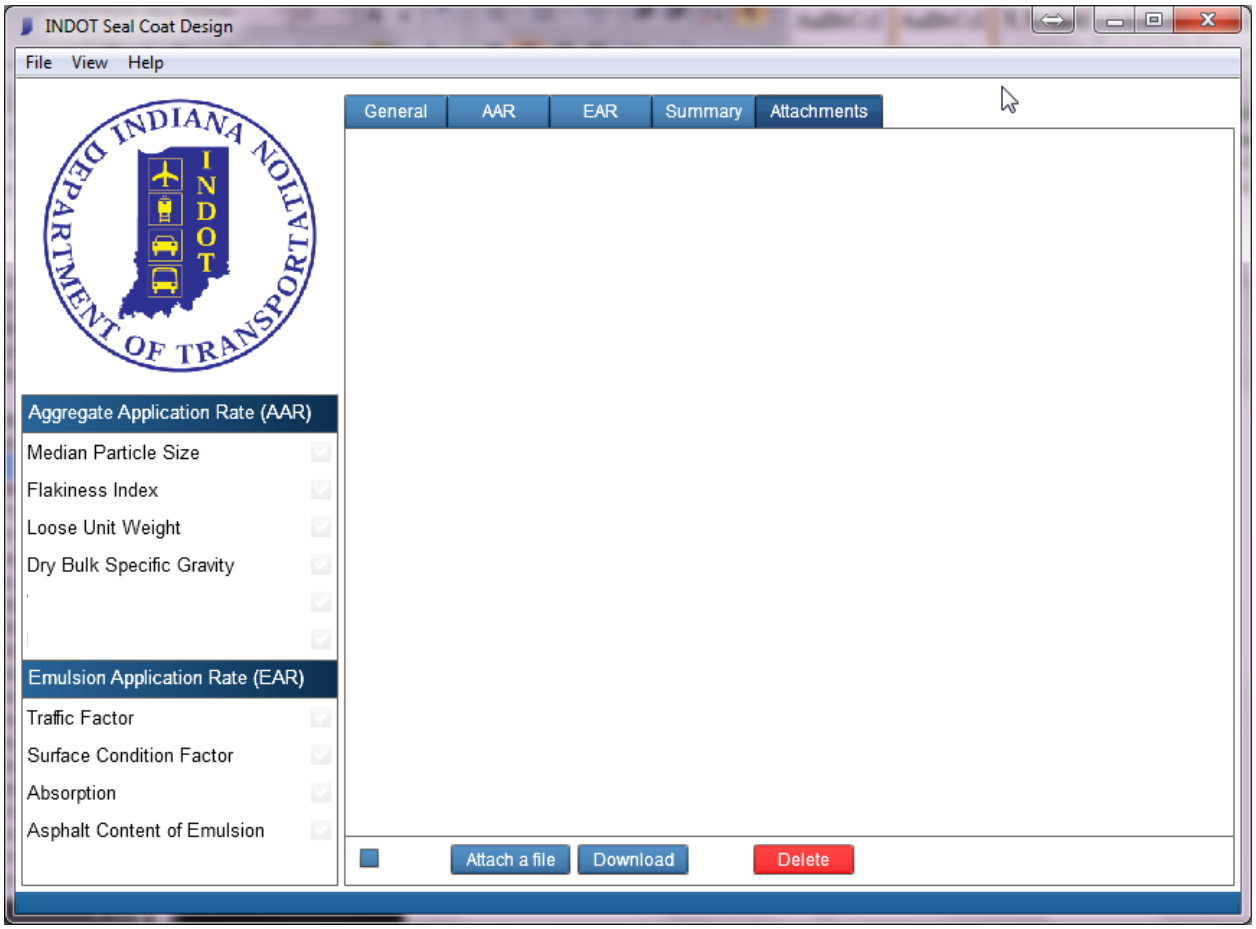
3.4.4 SUMMARY

The "Summary" tab presents all input values as a summary and instantly updates as any changes occurs in selected values. A small box featured in the right side of each line displays which type of value is used for each type of factor. AAR and EAR are also automatically calculated and displayed once the required data are defined in the software and update once any change in the value of each factor is detected. The "Summary" tab also features a "Print Report" option button in the left lower corner of the window, which allows a user to print detailed report. A detailed report shows every value input by a user and step-by-step calculation of the AAR and EAR in PDF format. The figures below illustrate how "Summary" tab displays type of factor as well as AAR and EAR.



3.4.5 ATTACHMENTS

The "Attachments" tab displays a list of attached files. This feature essentially works the same way as attaching a file to an email. Furthermore, it provides a drag and drop function, which allows a user to simply drag any file to a software window and automatically the file in that location. This feature also provides options to manage multiple files at once by selecting the check box located in the lower left corner of the window.

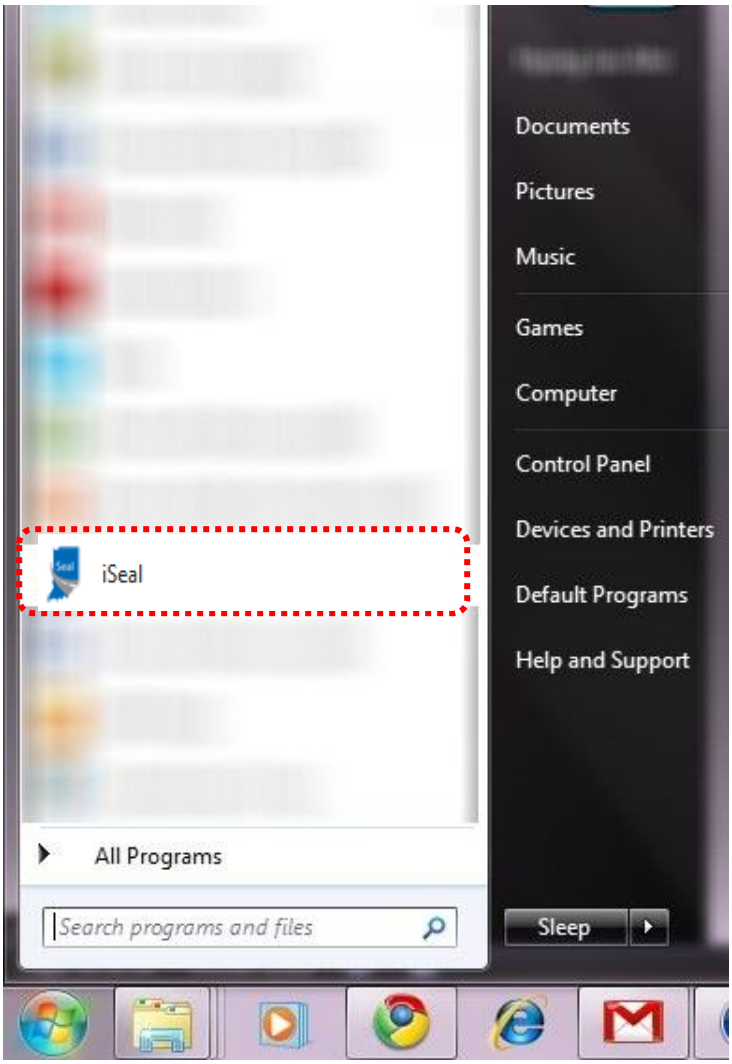


4 GETTING STARTED

4.1 LAUNCHING iSeal

Run iSeal by double-clicking on the iSeal icon on your desktop or

in your Windows **Start** menu.

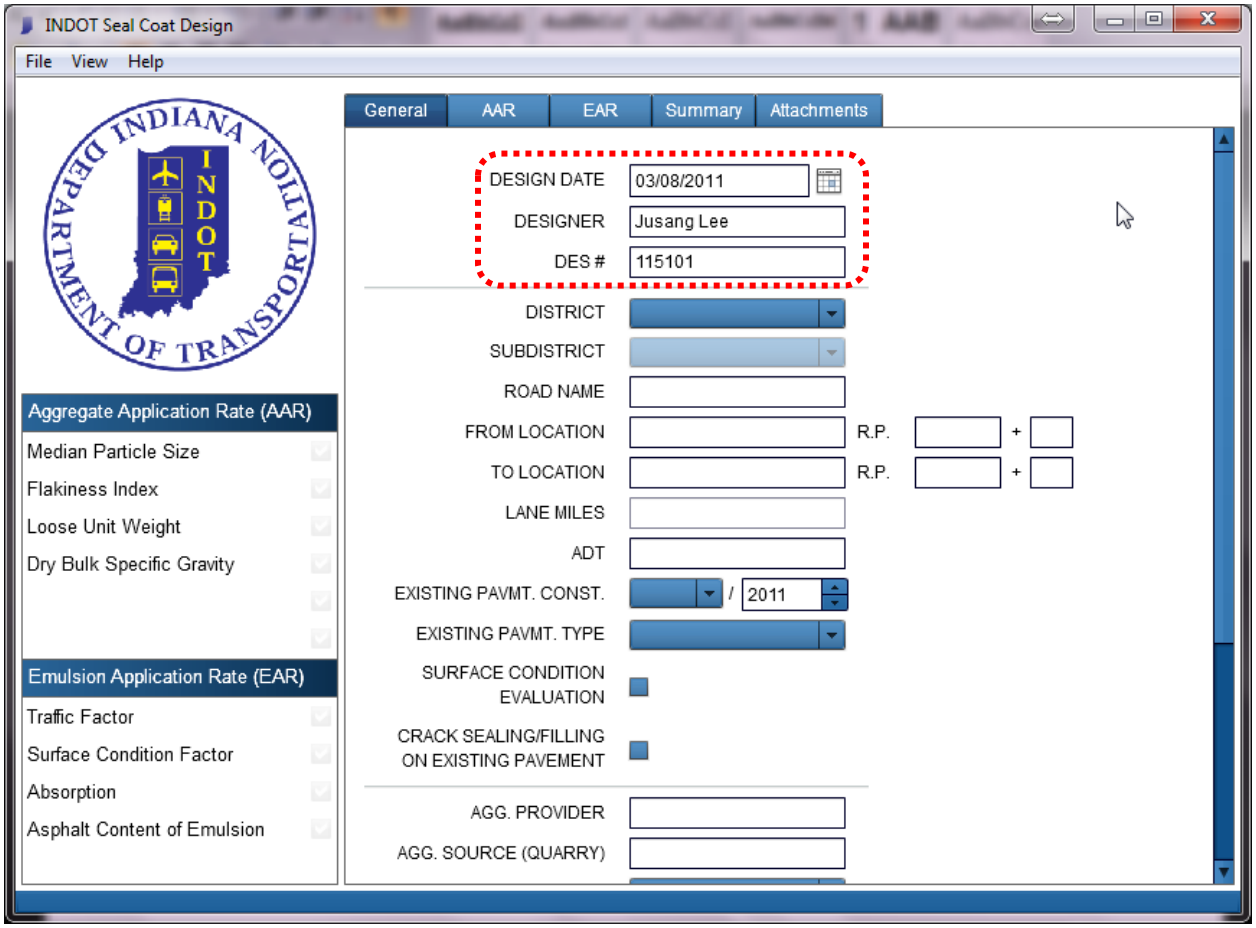


4.2 DESIGN EXAMPLE

The following example illustrates how to design AAR and EAR using iSeal step by step. Procedures presented in this example are designed to help the first-time user to become more familiar with iSeal, but hereafter a user may enter and edit values for each required input in any order.

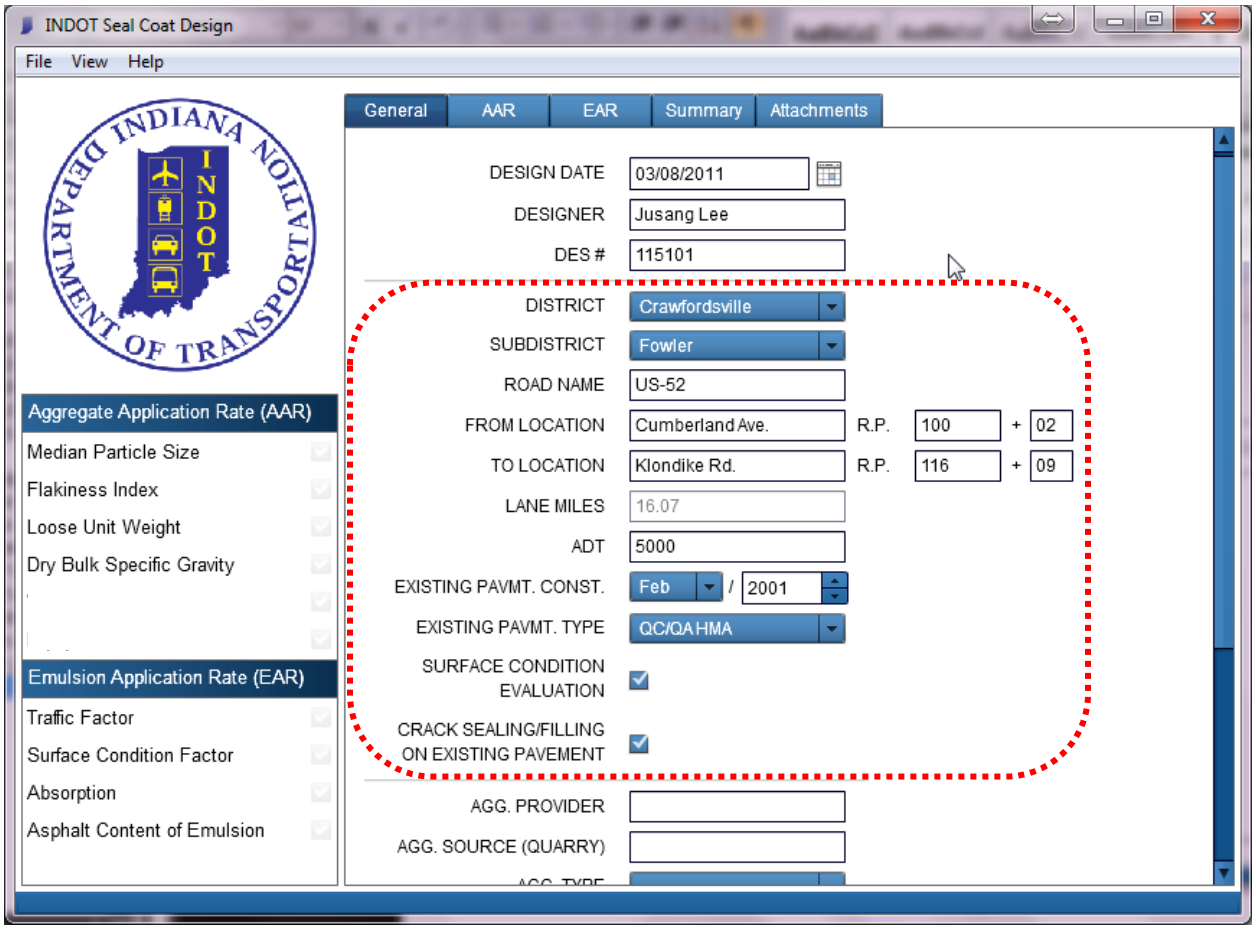
4.2.1 STEP 1

Enter designer name along with design date and DES number.

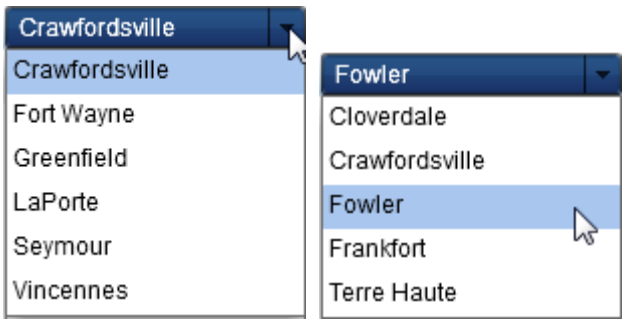


4.2.2 STEP 2

Enter location information, including existing pavement type and condition. Lane miles are automatically calculated once reference points are presented.



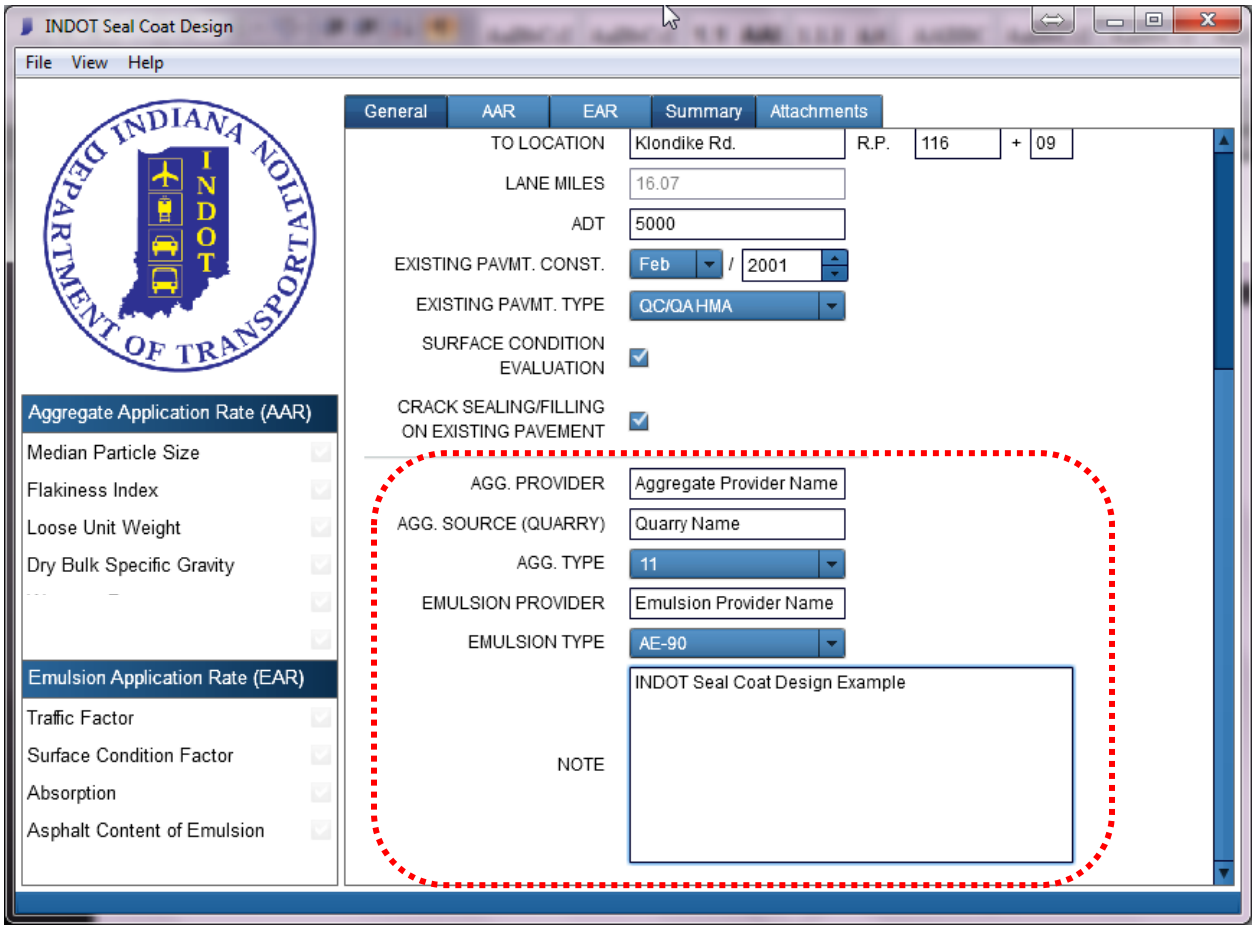
For district selection, the user can choose from one of six districts of Indiana. Once a district is selected, a list of subdistricts corresponding to the selected district becomes available.



4.2.3 STEP 3

Enter material information and additional comments in the blank space provided.

For aggregate and emulsion type selection, a user can only choose from the list provided, based on INDOT Standard Specification (2). Indiana aggregate No. 11 and AE-90S are selected in this example.

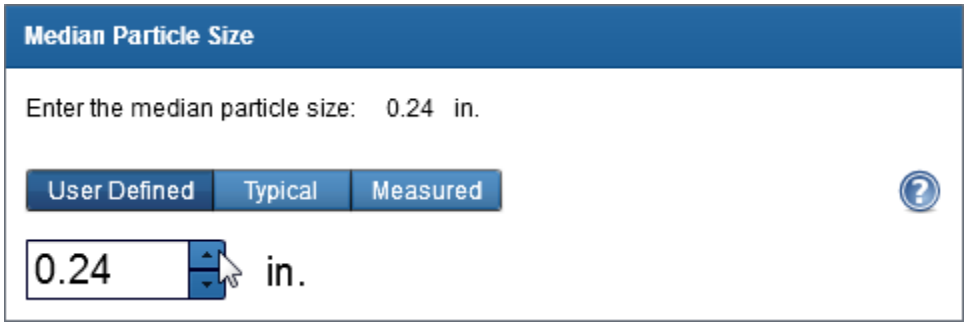


4.2.4 STEP 4

Enter the median particle size of aggregates used for the seal coat application using one of three input options.

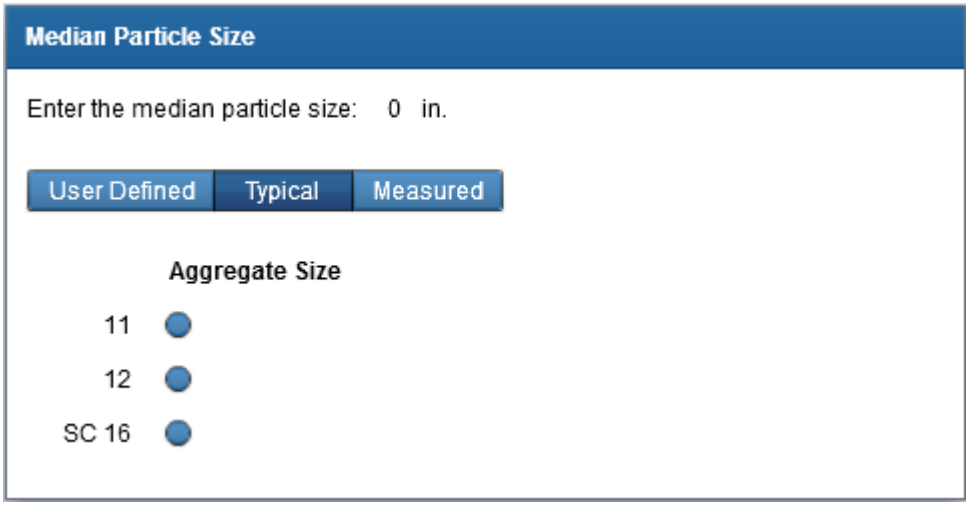
Option 1: **User Defined**

Input median particle size by typing in values in the box or using arrows.



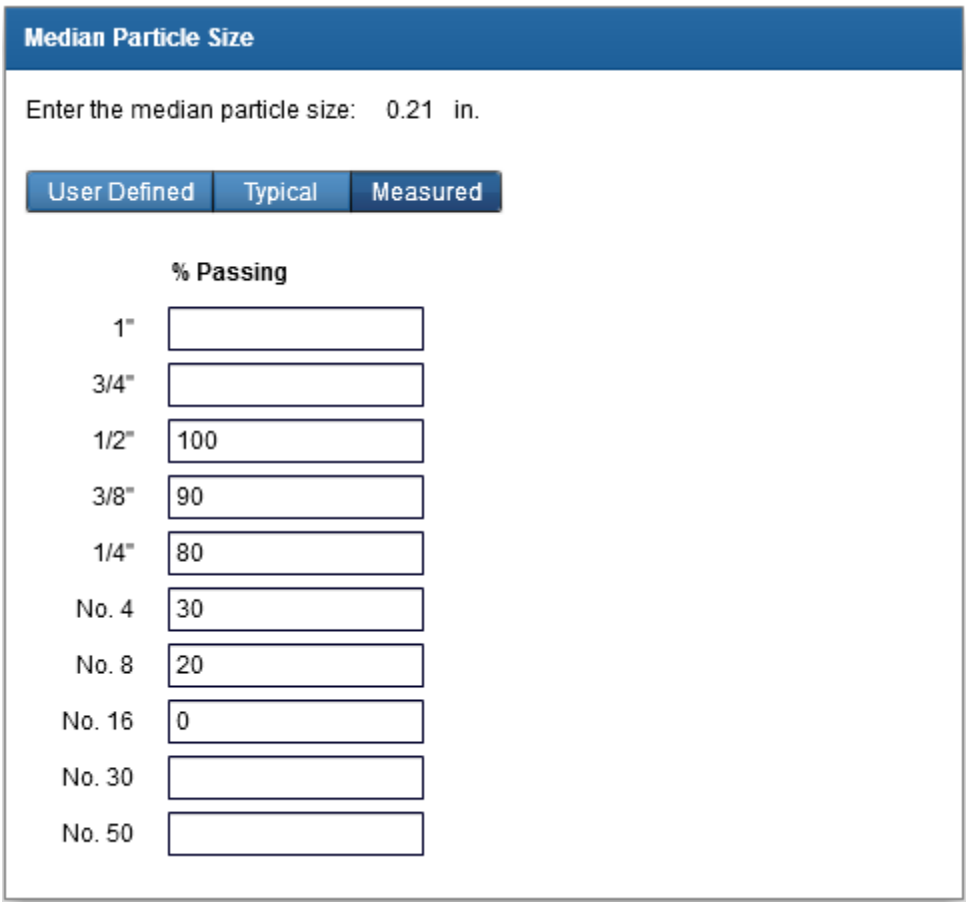
Option 2: **Typical**

Input median particle size by selecting one of five types of aggregate size.



Option 3: **Measured**

Input median particle size by providing the sieve analysis result.

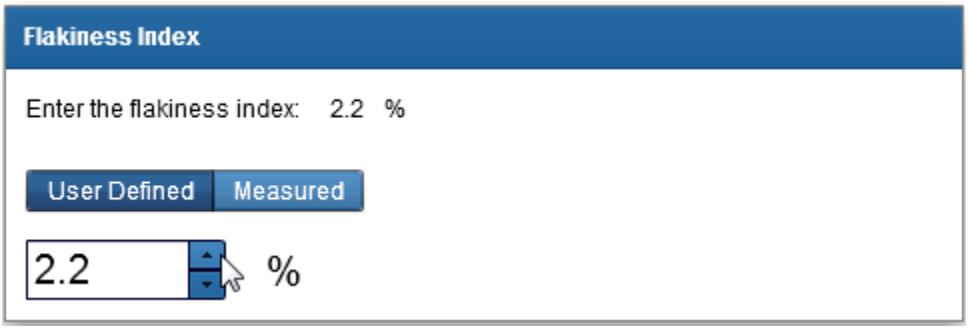


4.2.5 STEP 5

Enter Flakiness Index of aggregates used for seal coat application using one of two input options.

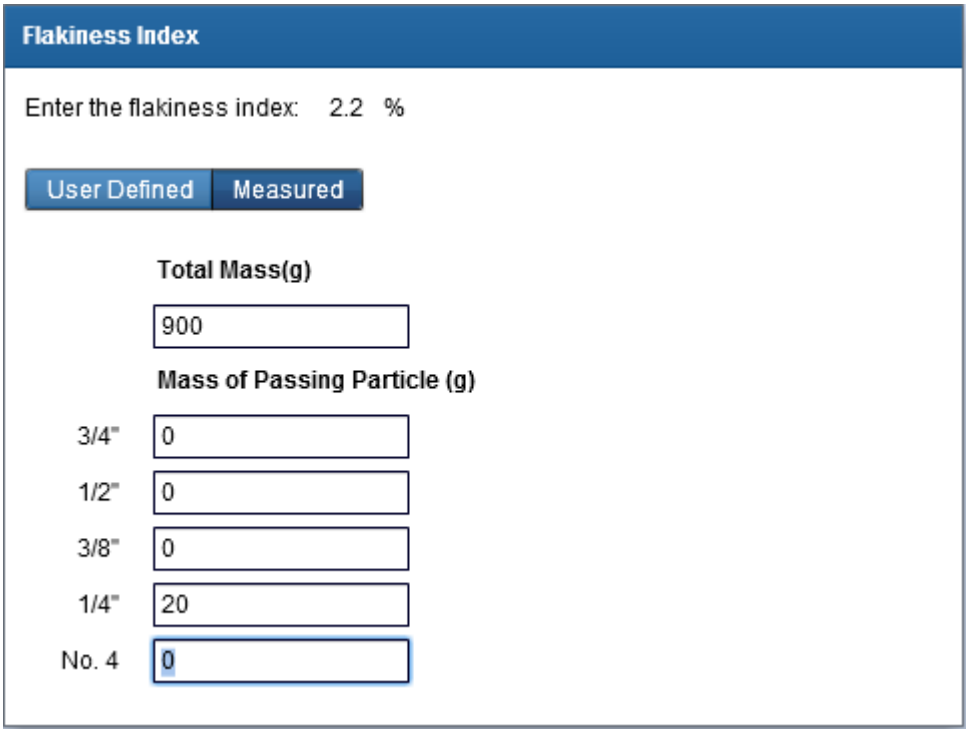
Option 1: **User Defined**

Input Flakiness Index by typing values in the box or using arrows.



Option 2: **Measured**

Input Flakiness Index by providing the test result.

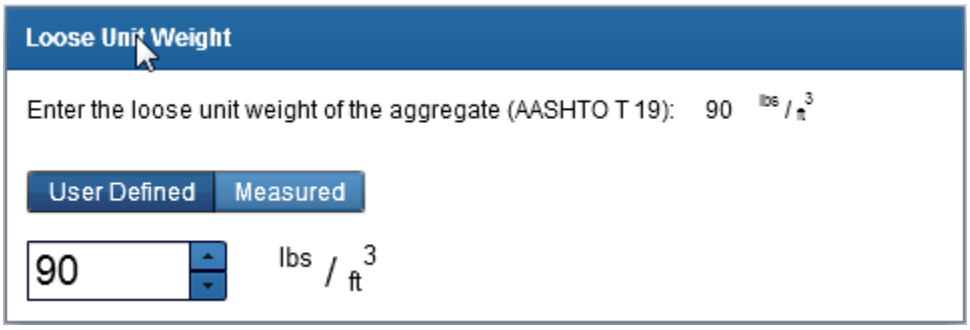


4.2.6 STEP 6

Enter loose unit weight of aggregates used for seal coat application using one of two input options.

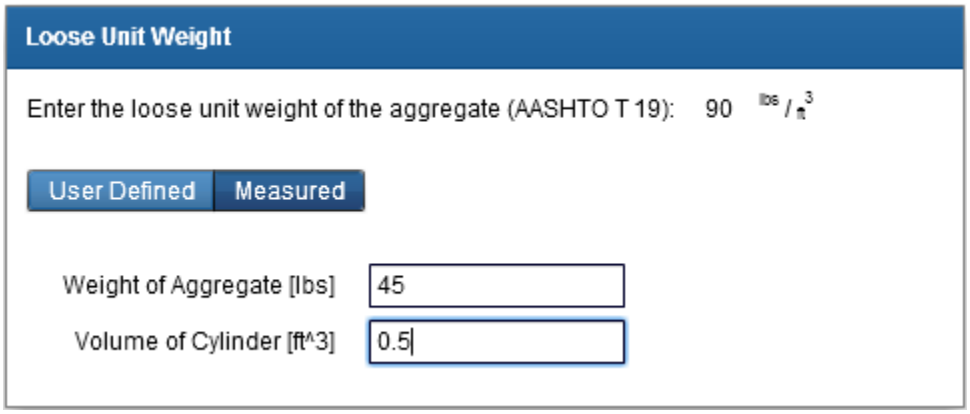
Option 1: **User Defined**

Input loose unit weight by typing in values in the box or using arrows.



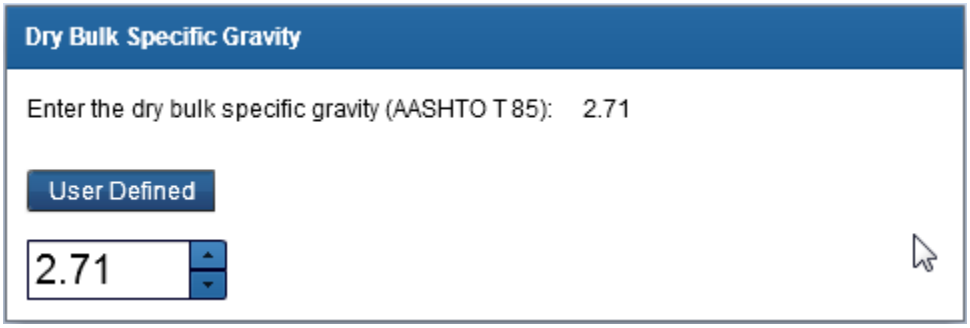
Option 2: **Measured**

Input loose unit weight by providing the test result specified by AASHTO T 19 (3).



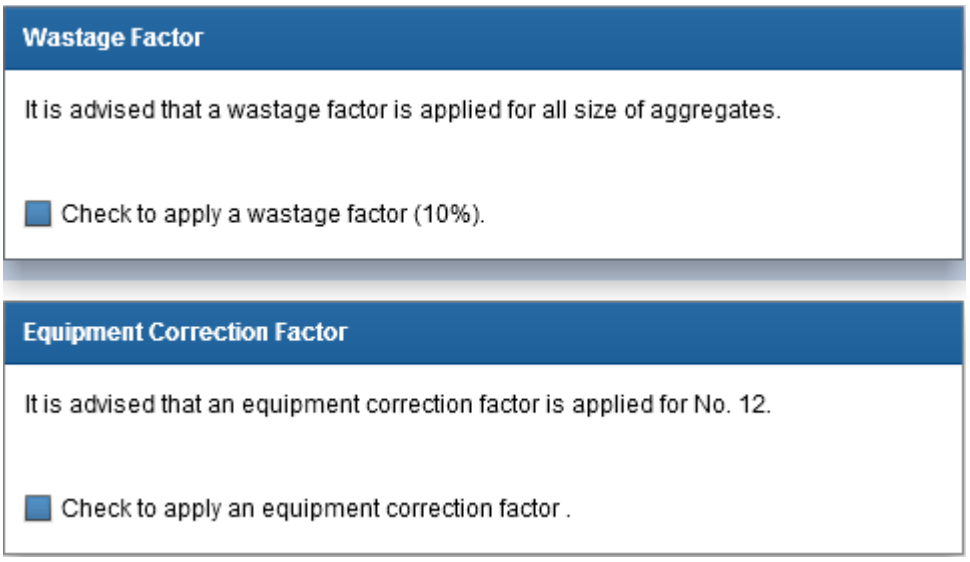
4.2.7 STEP 7

Enter the bulk specific gravity of aggregates used for seal coat application. AASHTO T 85 covers determination of the specific gravity of coarse aggregate (4).



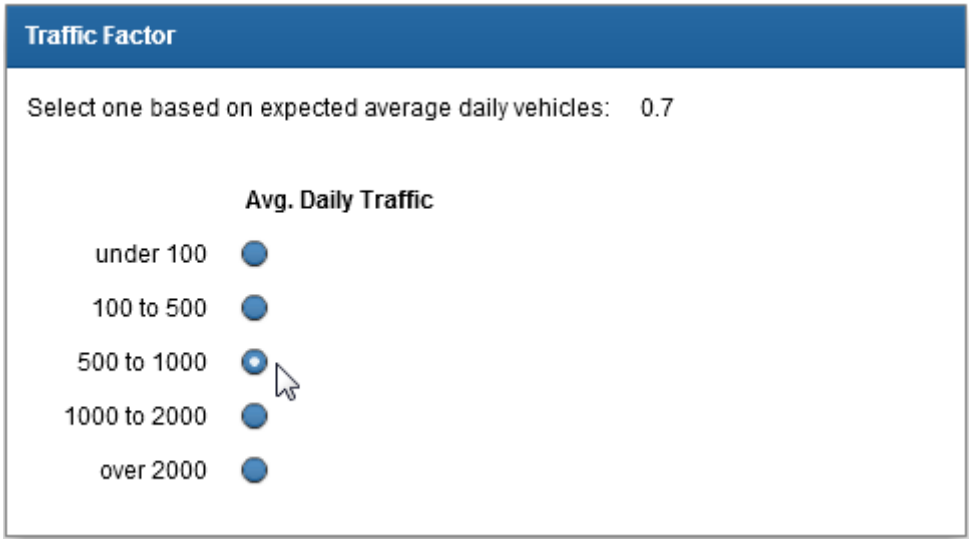
4.2.8 STEP 8

Choose whether the wastage factor or equipment correction factor is used in the seal coat design. Findings from the study SPR-3087 recommend using both factors.


Wastage Factor
It is advised that a wastage factor is applied for all size of aggregates.
Check to apply a wastage factor (10%).
Equipment Correction Factor
It is advised that an equipment correction factor is applied for No. 12.
Check to apply an equipment correction factor .

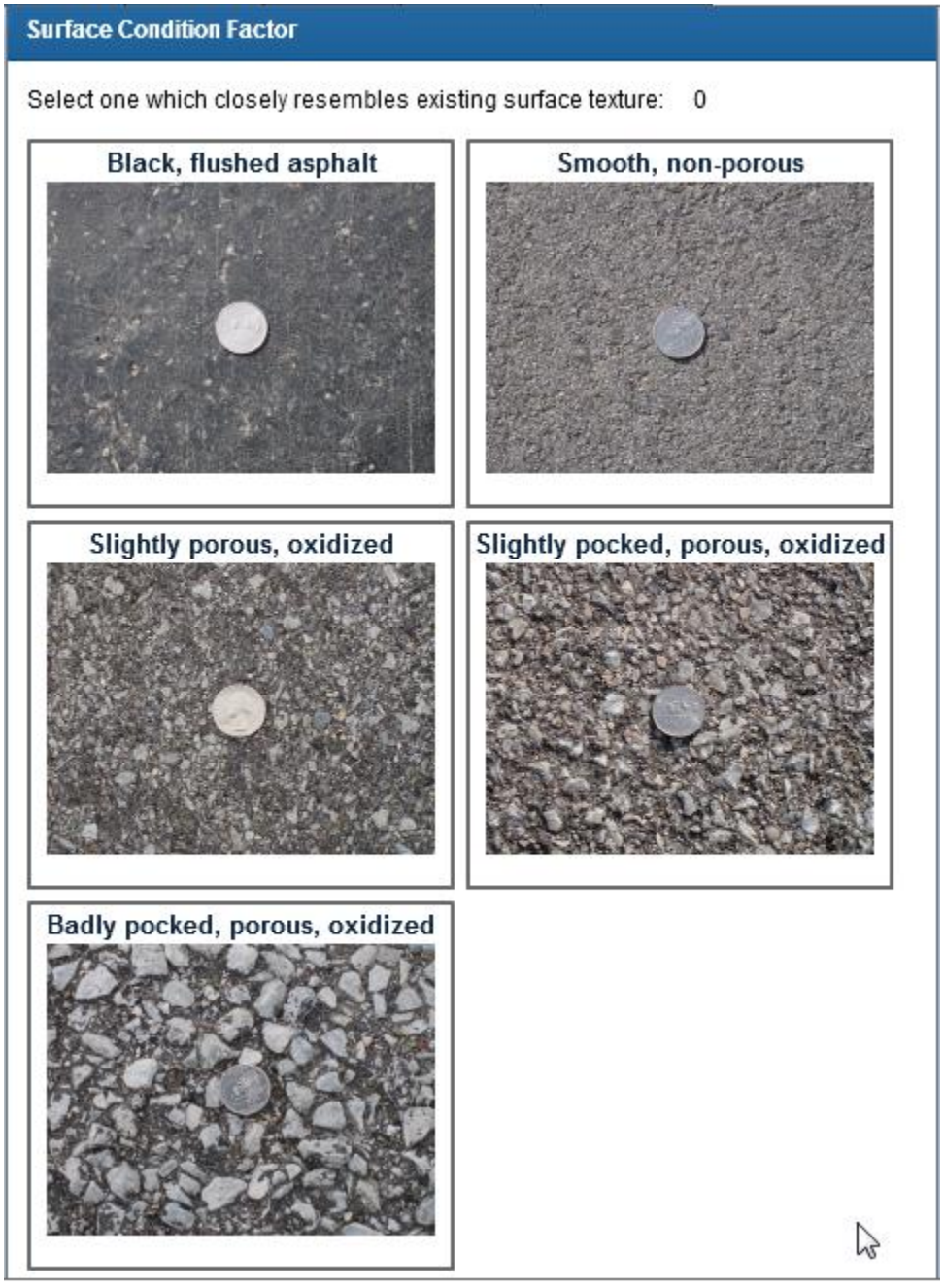
4.2.9 STEP 9

Select one of five categories of average daily traffic for road segments on which the seal coat will be applied.



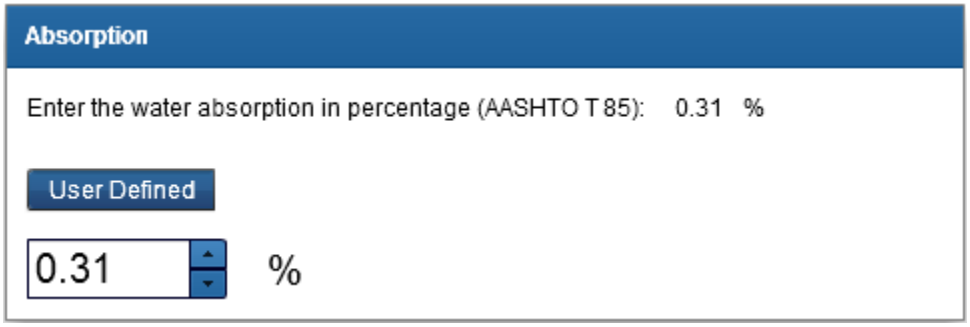
4.2.10 STEP 10

Select one of five categories of surface condition for road segments on which the seal coat will be applied.


Surface Condition Factor
Select one which closely resembles existing surface texture: 0
Black, flushed asphalt
Smooth, non-porous
Slightly porous, oxidized
Slightly pocked, porous, oxidized
Badly pocked, porous, oxidized

4.2.11 STEP 11

Enter the water absorption of aggregates used for the seal coat application. AASHTO T 85 covers determination of water absorption of coarse aggregate (4).

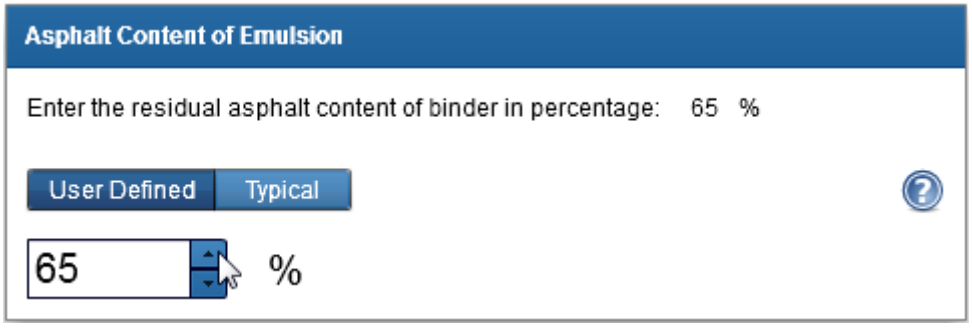


4.2.12 STEP 12

Enter the asphalt content of the emulsion used for the seal coat application using one of two input options.

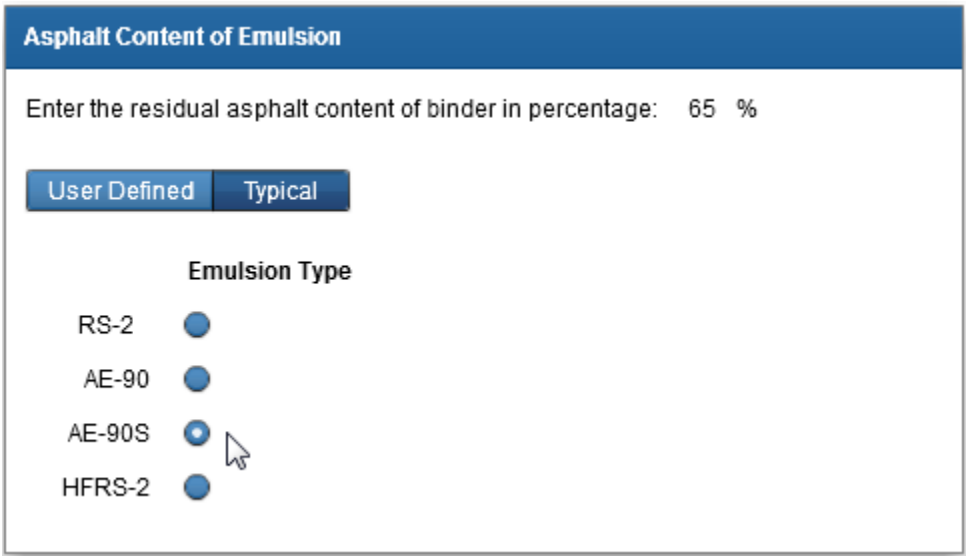
Option 1: **User Defined**

Input the asphalt content of the emulsion by typing values in the box or using arrows.



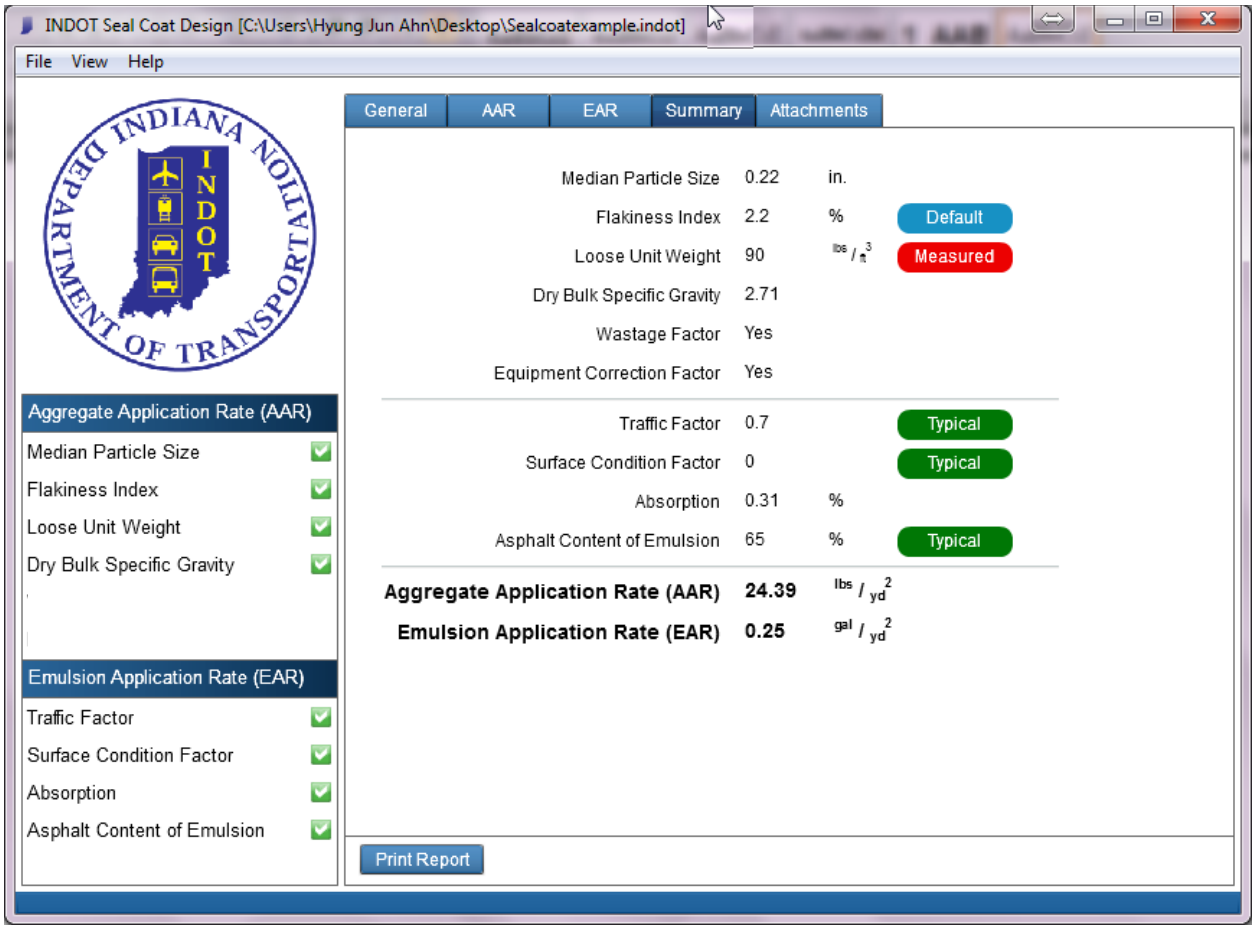
Option 2: **Typical**

Input the asphalt content of the emulsion by selecting one of four types of emulsions specified in the INDOT Specification.



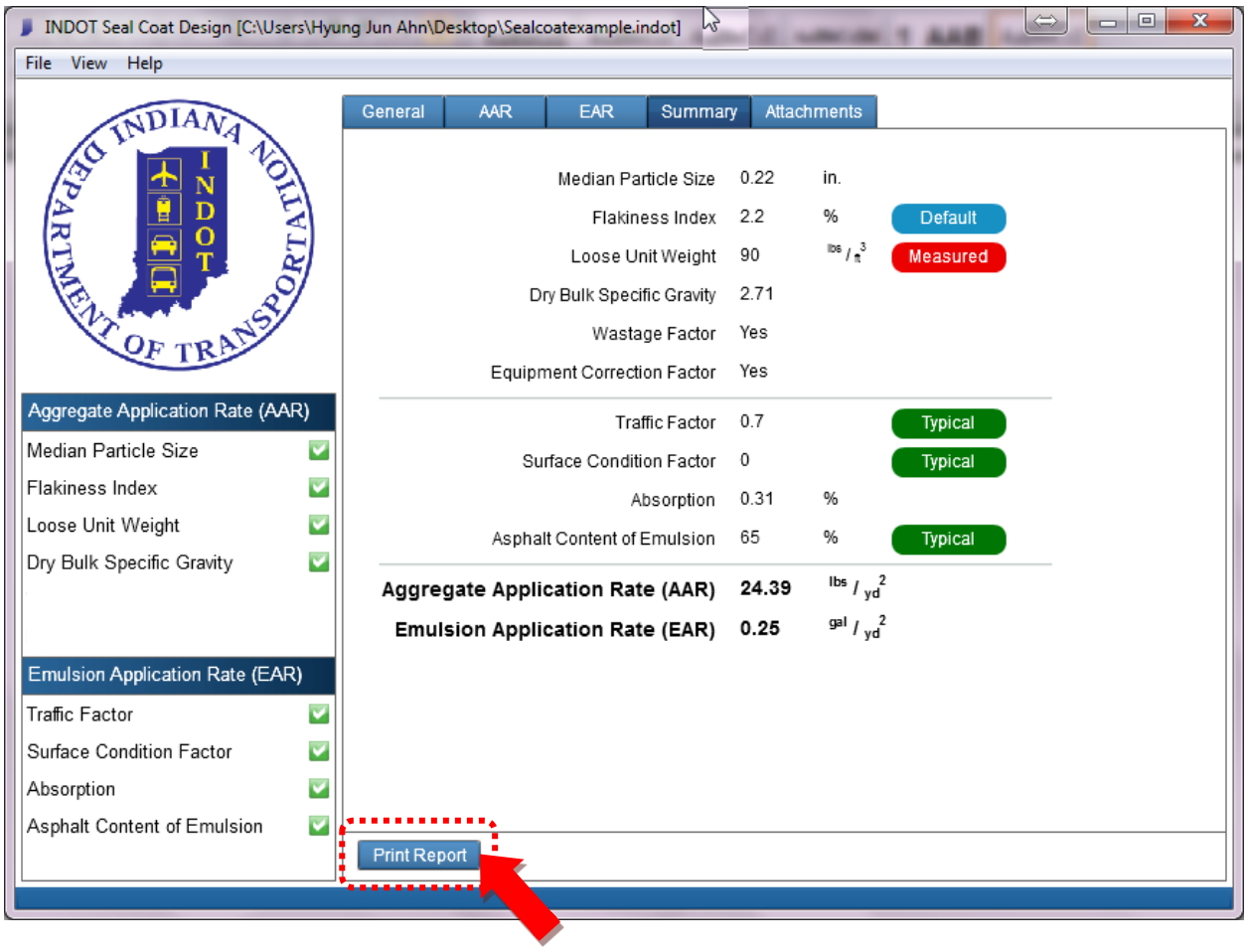
4.2.13 STEP 13

Review the input values. iSeal generates the AAR and EAR once the necessary input values are presented.



4.2.14 STEP 14

If you would like to print a detailed report that contains general information as well as each step of the seal coat design calculation, click the **Print Report** button located at the bottom of the window. iSeal will generate a report in PDF format.

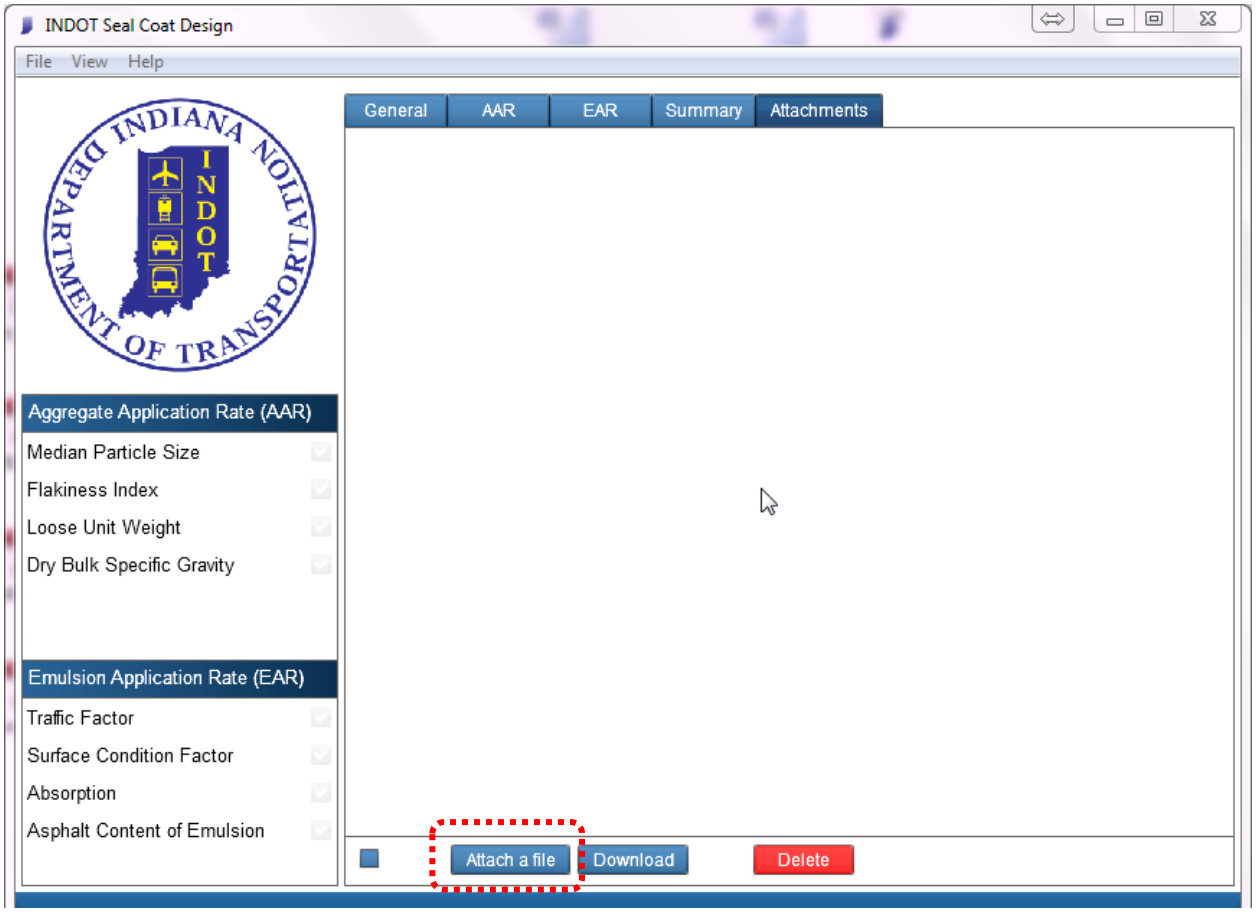

INDOT Seal Coat Design [C:\Users\Hyung Jun Ahn\Desktop\Sealcoatexample.indot]
File View Help
General AAR EAR Summary Attachments
Median Particle Size 0.22 in.
Flakiness Index 2.2 % Default
Loose Unit Weight 90 lbs / ft3 Measured
Dry Bulk Specific Gravity 2.71
Wastage Factor Yes
Equipment Correction Factor Yes
Traffic Factor 0.7 Typical
Surface Condition Factor 0 Typical
Absorption 0.31 %
Asphalt Content of Emulsion 65 % Typical
Aggregate Application Rate (AAR) 24.39 lbs / yd2
Emulsion Application Rate (EAR) 0.25 gal / yd2
Aggregate Application Rate (AAR)
Median Particle Size
Flakiness Index
Loose Unit Weight
Dry Bulk Specific Gravity
Emulsion Application Rate (EAR)
Traffic Factor
Surface Condition Factor
Absorption
Asphalt Content of Emulsion
Print Report

4.2.15 STEP 15

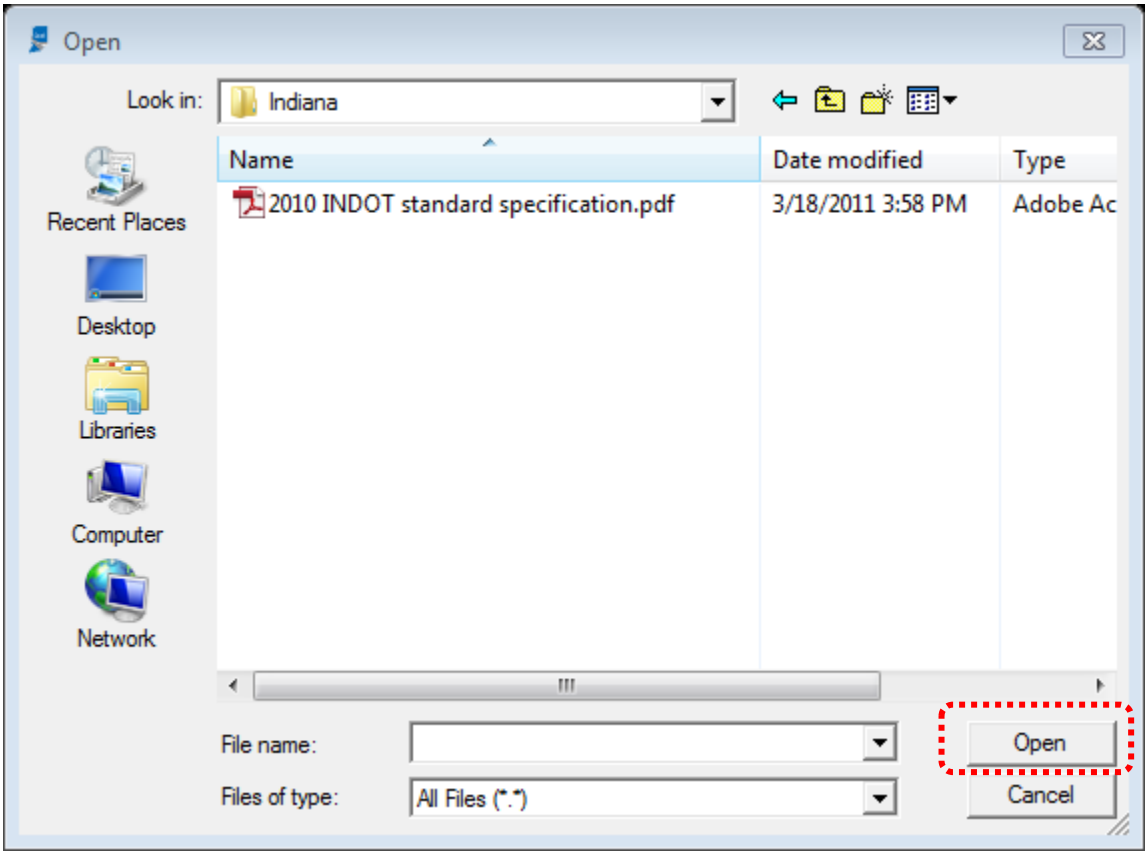
The user can attach any type of file with no size limit. The figure below illustrates how to add or delete attached files.

To add files, follow these steps:

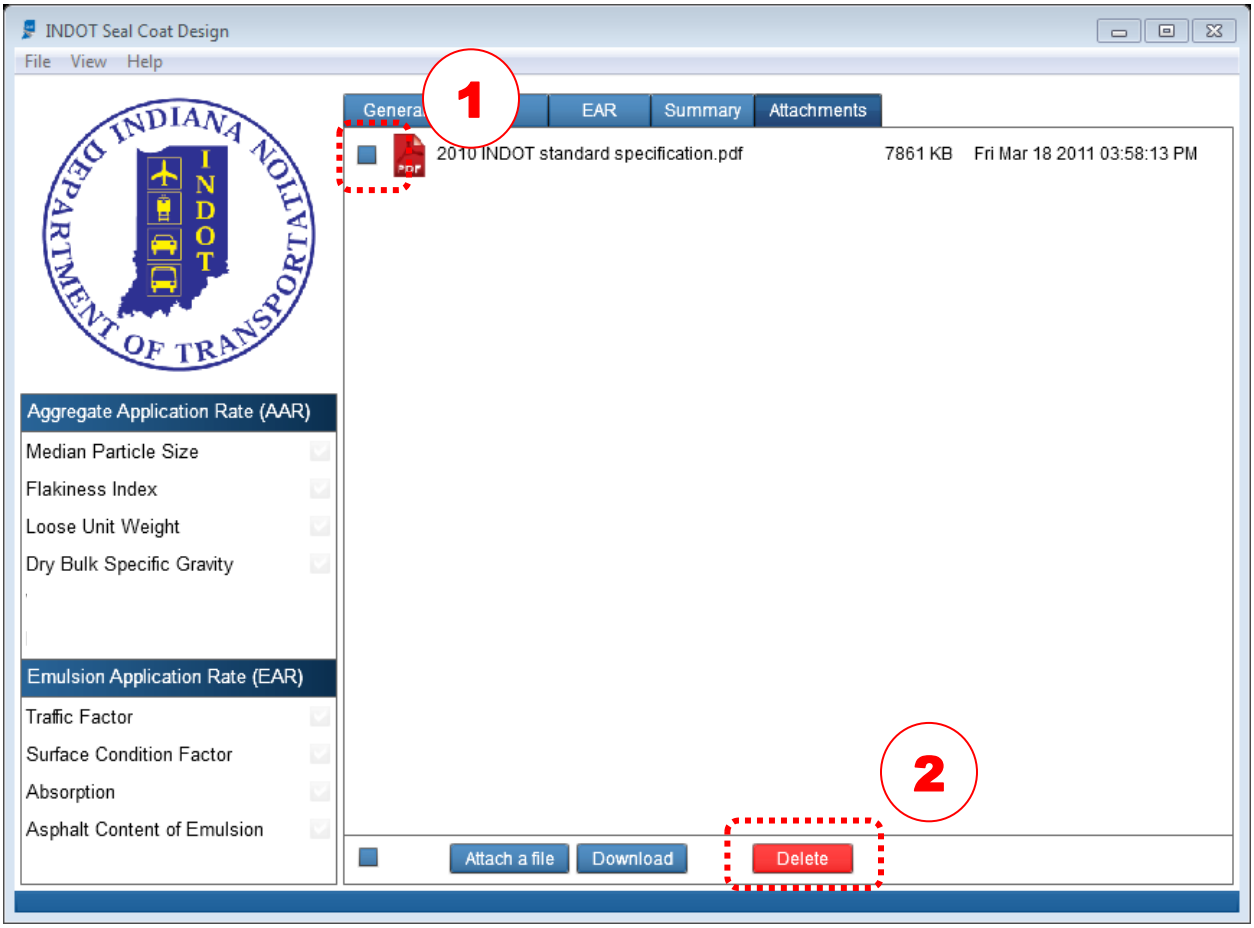
1. Click the **Attach a File** button.



2. Select a file and then click **Open**.



To delete files, select files by clicking the box, then click the **Delete** button

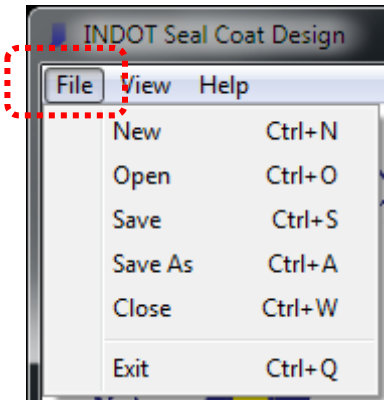


4.2.16 STEP 16

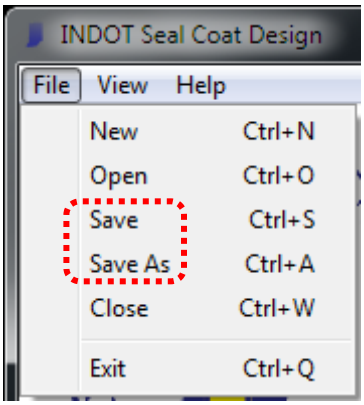
The last step is to save your work. You can save your work at anytime by typing the keyboard shortcut CTRL + S.

To save your work, follow these steps:

1. Click the **File** button.



2. Click either the **Save** or the **Save As**.



5 REFERENCES

1. **Indiana Department of Transportation.** The Indiana Design Manual 2010. *Indiana Department of Transportation.* [Online] Indiana Department of Transportation, January 21, 2010. http://www.in.gov/dot/div/contracts/standards/dm/.
2. —. *INDOT Standard Specifications.* s.l. : Indiana Department of Transportation, 2010.
3. **AASHTO.** Standard Method of Test for Bulk Density and Voids in Aggregate. s.l. : American Association of State Highway Transportation Officials. AASHTO T 19.
4. —. Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate. s.l. : American Association of State Highway and Transportation Officials, 2010. AASHTO T 85.